

LETTERS TO THE EDITOR.

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The Hydrography of the Faeroe-Shetland Channel.

IN that portion of the programme of international investigation of the North Sea (as finally drawn up by the conference at Copenhagen last July) which provides for a coordinated series of hydrographic cruises at intervals of three months, it falls to Scotland to investigate the Faeroe-Shetland Channel and adjacent waters. It was important that the work should be begun as soon as possible, and especially so in order that the sea-temperatures, &c., should not go unrecorded in this abnormal season; but it would have been impossible to begin at so short notice had not Dr. Hjort, the director of the Norwegian investigation, helped by the loan of apparatus and by permitting his hydrographic assistant, Mr. Helland-Hansen, to come over and inaugurate the work. The Admiralty gave the use of H.M.S. *Jackal*; Lieutenant and Commander Sharpe and Mr. Helland-Hansen were conjointly responsible for the observations, and the report will be drawn up by Mr. Helland-Hansen, who has sent me the preliminary account which follows. The *Jackal's* course lay from the Moray Firth to Lerwick, thence in a north-easterly direction nearly to the Norwegian coast, then west to the Faeroes, thence to Fair Isle and out into the North Sea again; and it was so planned as to give, over each of the more important areas, double and approximately parallel lines of observations. Between August 25 and September 1, hydrographic observations were taken at twenty-six stations, and in addition surface-temperatures were taken every hour. A small number of plankton samples was collected also, but not to the extent that will be done on future cruises.

D'ARCY W. THOMPSON.

The Cruise of H.M.S. "Jackal," August, 1902.

The following short account is only a preliminary one and is given with some reservation, as the time has not yet permitted to draw the final results. In some weeks, however, we shall know the results of the investigations of the Norwegian fishery steamer *Michael Sars* from the neighbouring seas during the same period, and then we shall be able to work out the material from the *Jackal* very completely.

The best result from the *Jackal* expedition is, perhaps, that for the time in question we shall be able partially to solve the problem, equally important to hydrographers and biologists, of the quantity of Atlantic water entering the North Sea and the Norwegian Sea. Many years ago, and by different investigators, it was demonstrated that a large quantity of Atlantic water moved to the north between the Faeroes and Shetland (the Gulf Stream), and also that Atlantic water to the north and north-east of Scotland flowed in a south-westerly direction into the North Sea. Now we have undoubtedly found some unknown details of great importance.

(1) The Gulf Stream is in the Faeroe-Shetland Channel divided from beneath by a deep wedge of cold and less salt water coming from the north. The influence of this cold water is traced even to the surface. Thus we have really two parallel branches of the Gulf Stream from the Faeroe-Shetland Channel to the north. This fact may be shown by the following table. Station xii. (61° 2' N., 1° 10' W.) is situated near Shetland, and station xvi. (61° 47' N., 6° 4' W.) near the Faeroes. The temperatures and salinities at, for instance, 300 metres' depths—stations xiii. (61° 12' N., 2° 5' W.), xiv. (61° 25', 3° 24' W.) and xv. (61° 35' N., 4° 39' W.)—are very typical.

Stations.

Depth in metres.	xii.		xiii.		xiv.		xv.		xvi.	
	Tem. °C.	Salin. ‰	Tem. °C.	Salin. ‰	Tem. °C.	Salin. ‰	Tem. °C.	Salin. ‰	Tem. °C.	Salin. ‰
0	11° 3'	35° 33'	11° 2'	35° 31'	9° 5'	34° 96'	8° 9'	34° 98'	9° 2'	35° 19'
40	10° 8'	35° 32'	10° 7'	35° 31'	10° 0'	35° 07'	8° 9'	35° 11'	8° 7'	35° 17'
100	9° 4'	35° 32'	9° 4'	35° 31'	ca.	35° 14'	8° 2'	35° 20'	8° 5'	35° 19'
200	Bottom		8° 9'	35° 32'	6° 3'	35° 10'	7° 7'	35° 20'	Bottom	
300			8° 5'	35° 32'	3° 6'	34° 97'	6° 9'	35° 14'		
400							6° 4'	35° 09'		
500			6° 6'	35° 17'	1° 2'	34° 95'				

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As the cold water from the north and the warm water from the south have very different influences upon organic life, the discovery of such a division of the Gulf Stream will probably be of importance in understanding the distribution of the organisms.

(2) In August comparatively little Atlantic water enters the North Sea in the surface between Scotland and Shetland. The influx of Atlantic water chiefly takes place close to the coast of Scotland, at a distance of about twenty to forty nautical miles away from the coast. [Further away, at about eighty miles' distance, the surface-water seems to move in a northerly direction. This cannot be certainly decided, however, until a minute examination of the hydrodynamic conditions has taken place.]

(3) Another branch of Gulf Stream-water enters the North Sea between Shetland and Norway.

(4) In the north-western part of the North Sea we find at the bottom (below thirty to forty fathoms from the surface) a layer of remarkably cold and salt water; it is much saltier than the surface-water. It is too salt to be Arctic water and too cold to be summer water from the Atlantic Ocean. I think it probable that this bottom layer consists of Atlantic water that has been at the surface in winter time. Our hydrographical observations, then, seem to indicate that the influx of Atlantic water into the North Sea in winter time takes place to a much greater extent than in summer time. To find the laws of the variations of this influx, however, we must have autumn and winter observations.

The regions where the *Jackal* collected her material this year were previously incompletely explored. I have only now had an opportunity to compare our observations with those found in Mr. H. N. Dickson's excellent paper on "The Circulation of the Surface-Waters of the North Atlantic Ocean" (published 1901). Unfortunately, Mr. Dickson's observations are limited to the surface. It seems as if the influx of the cold water from the north and the east Icelandic Polar current this year were much stronger than in, e.g., 1896. In the western part of the channel, the surface-temperatures this year were about 1°–1½° C. lower than in 1896, and the Gulf Stream seems to have been narrower. This may probably be connected with the unusually cold weather of this year.

B. HELLAND-HANSEN.

Matriculation Requirements in Scottish Universities.

IN reference to a remark made in my address published in NATURE last week, Prof. A. Gray tells me that matriculation in the Scottish universities is no longer the simple matter it was in my time. Before entering on his qualifying course of study, every candidate for a degree in arts or science must now pass a preliminary examination.

JOHN PERRY.

Royal College of Science, London, October 27.

The Neglect of Anthropology in British Universities.

THE recent publication in NATURE (August 28, p. 430) of an abstract of Prof. Haddon's presidential address to the Anthropological Institute, affords an opportunity of bringing before the scientific public, by way of contrast, a concise statement of what is being at present done in Britain to forward anthropological science.

Of all the universities in Britain, two only attempt systematic teaching in this subject, viz. Oxford and Cambridge, while in a third, viz. Aberdeen, there has existed since 1899 a society having for its object the promotion of anatomical and anthropological research. In Oxford there is a poorly paid professorship of anthropology, but in Cambridge even this scanty recognition is not vouchsafed to the subject, for in that University there are two lectureships of but 50*l.* a year each, established in 1899 and 1900 respectively for five years. One of these lectureships is devoted to physical anthropology and is attached to the School of Human Anatomy. The other, held by Prof. Haddon himself, is for ethnology, and covers the wide field of all relating to the industries, customs and beliefs of primitive peoples, now in many cases approaching extinction, and the loss by disinterestedness of their primitive customs and unwritten records. It cannot be expected that any real advance in these branches of science can be made in Britain while they are so pitifully starved, and while the men holding mere precarious appointments are not deemed worthy of their hire.

Now that the war is over, cannot some appeal be made to remedy this state of things? Is it too much to hope that a chair for ethnology might be endowed by private benefaction for the new teaching University of London, or at least that subscriptions might be secured sufficient to place the existing lectureships in Cambridge on a sounder and more satisfactory basis?

ANTHROPOTAMIST.

Phosphorus versus Lime in Plant Ash.

THAT in the mineral constituents of leaves a strong proportion of lime is an obstacle to the presence of a considerable quantity of potash has been recognised as a feature of calcifugous species of plants. It has been sought, indeed, to explain, apparently on this ground alone, the existence of special plants which shun lime soils, or at least to account for the difference between their habitat and that of calcicolous species. A certain proportion of lime in the soil, say about 12 per cent. carbonate, is sufficient for the needs of a certain number of calcicolous species and banishes the calcifugous species from it. If, however, we carefully examine the ash constituents of the leaves of herbs growing and seeding in a soil (such as here in this valley) with only about 1 per cent. lime (CaO) in its finer particles, we recognise a large ratio both of potash and of lime, as the annexed table will attest.

Leaves of	Date.	Per-cent- age of Ash.	Constituents of the Ash.		
			Soluble Salts.	CaO.	P ₂ O ₅ .
Hawkweed	July 15	12.6	24.7	28.4	4.3
Figwort	" 24	8.9	31.7	24.7	8.35
Bracken (stem)	" 24	—	63.8	4.1	3.04
Cranesbill (lamina) ...	" 27	7.5	38.3	24.9	9.5
Hazel	" 29	6.3	18	30.4	7.7
Rowan	" 31	6	38.5	23	5.6
Dock	Aug. 1	11.7	43.4	20	6.3
Water Flag	" 5	8.7	42.2	29	6
Sycamore	" 5	10.5	33.6	25.7	4.7
Great Knapweed.....	" 12	10	37.1	29.4	3.6
Ragwort	" 19	12.2	44.5	23.7	5.15
Foxglove	" 21	9.1	40.7	25.3	5
Heather (whole plant)...	Sept. 19	2.2	25	16.3	7.3
Sycamore fruit.....	" 24	5.5	37	25.7	8

These figures are taken from my own analyses, the percentages being calculated on the crude ash minus charcoal. The sphere of experimental observation is, perhaps, too narrow or restricted, but a suspicion is awakened by the results that the need for phosphorus is a direct or indirect agent operative in the case. That is to say, a strong proportion of lime in the ash seems rather an auxiliary or accompaniment than an obstacle to a strong proportion of potash (as computed by the soluble salts). On the other hand, we see a rough approximation to an inverse ratio between the lime and the phosphorus, *i.e.* roughly 28 or 29 per cent. of lime with 3 or 4 P₂O₅, and 23 or 24 lime with 8 or 9 P₂O₅; and where this does not prevail, the whole percentage of ash is below the average (as in water flag and the woody plants). That a poor yield of certain plants on calcareous soils appears to be due to the effect of the lime in preventing the assimilation of phosphorus is a result of the experiments of MM. Dehérain and Demoussy. Moreover, it is known that the ash of seeds, which is invariably very rich in phosphorus, contains also a comparatively very small proportion of lime. It would seem, therefore, to be legitimate to conclude that a certain proportion of lime in the soil (say 3 or 4 per cent.) is inimical to the life of certain plants which require a definite amount of phosphoric acid for the healthy performance of their physiological functions. The fact that some plants will grow, but not flourish or propagate, in certain localities or habitats is a pretty certain indication that a sufficient amount of phosphorus is not available to the seed for purposes of germination and development. The analyses would seem to indicate that a too liberal supply of lime is the preventative agent in the case.

P. Q. KEEGAN.

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ALUMINIUM AND ITS ALLOYS.

THE electrolytic process for the extraction of aluminium, which was patented in 1887 by Héroult in Europe and by Hall in America, has resulted in such a great diminution in the cost of production that the price of the metal has fallen from about twenty shillings to one shilling a pound. It is not surprising that, in the early days of the electrolytic industry, this circumstance, combined with the many very valuable properties of aluminium, caused extravagant hopes for its future to be raised.

The experience that has been gained in the past five or ten years has enabled us to form a truer estimate of the value of the metal, though it would be difficult to say even now to how great an industrial importance it may ultimately develop. A very good idea of the present position and prospects of the industry may be obtained from two papers recently published in the *Journal* of the Institution of Electrical Engineers.¹ The first of these, by Prof. E. Wilson, gives the results of an elaborate series of tests of the physical properties of a number of aluminium alloys; we shall have occasion to refer to this paper later. The second paper is by Mr. W. Murray Morrison, and contains a description of the British Aluminium Company's works at Foyers and an account of the applications of the metal, its use as an electrical conductor being considered at some length. We are enabled by the courtesy of the British Aluminium Company to give an illustration showing the turbo-generators in the power-house at Foyers.

The Hall and Héroult processes for the electrolytic extraction of aluminium are practically identical and are too well known to need lengthy description. The aluminium is obtained as the result of the electrolysis of alumina dissolved in melted cryolite (6NaF.Al₂F₆). The electrolysis is carried out in a carbon-lined crucible, at the bottom of which the separated metal collects, the liberated oxygen combining with the carbon of the anode and passing off ultimately as carbon dioxide. It is interesting to note that, whereas the specific gravity of solid aluminium is less than that of solid cryolite, in the fused condition this order is reversed; but for this the process in its present form would be unworkable. Some figures showing the cost of production by the Héroult process are given by Mr. Blount in his "Practical Electrochemistry," as follows:—

Cost of power ...	2.2	pence	per lb.	of aluminium.
Cost of alumina ...	4.0	"	"	"
Cost of electrodes ...	2.0	"	"	"
Cost of labour, &c. ...	2.0	"	"	"
Total cost ...	10.2	"	"	"

It is probable that this estimate is somewhat high, but it is sufficient to show that the cost of power is a very important item, which explains the necessity for the use of water-power. The cost of power per lb. is higher than in any other electrolytic manufacture; it forms, it will be seen, about one-fifth of the total cost; in the manufacture of calcium carbide, another electrochemical industry requiring cheap power, the ratio of cost of power to total cost is about 1 to 7.5.

The product of the electrolytic furnace is very pure. According to Mr. Morrison, commercial aluminium is 99.5 to 99.6 per cent. pure, the impurities being iron (about 0.25 per cent.) and silicon (about 0.17 per cent.). A sample of pure commercial aluminium analysed by Prof. Wilson contained 0.31 per cent. Fe and 0.14 per cent. Si, which agrees pretty closely with Mr. Morrison's figures.

¹ "The Physical Properties of certain Aluminium Alloys, and some Notes on Aluminium Conductors," by Prof. E. Wilson. (*Journal I.E.E.*, vol. xxxi. p. 321.) "Aluminium: Notes on its Production, Properties and Use," by W. Murray Morrison. (*Ibid.* p. 400.)